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Light Water Reactor Sustainability (LWRS):

Nuclear Energy R&D for existing plants

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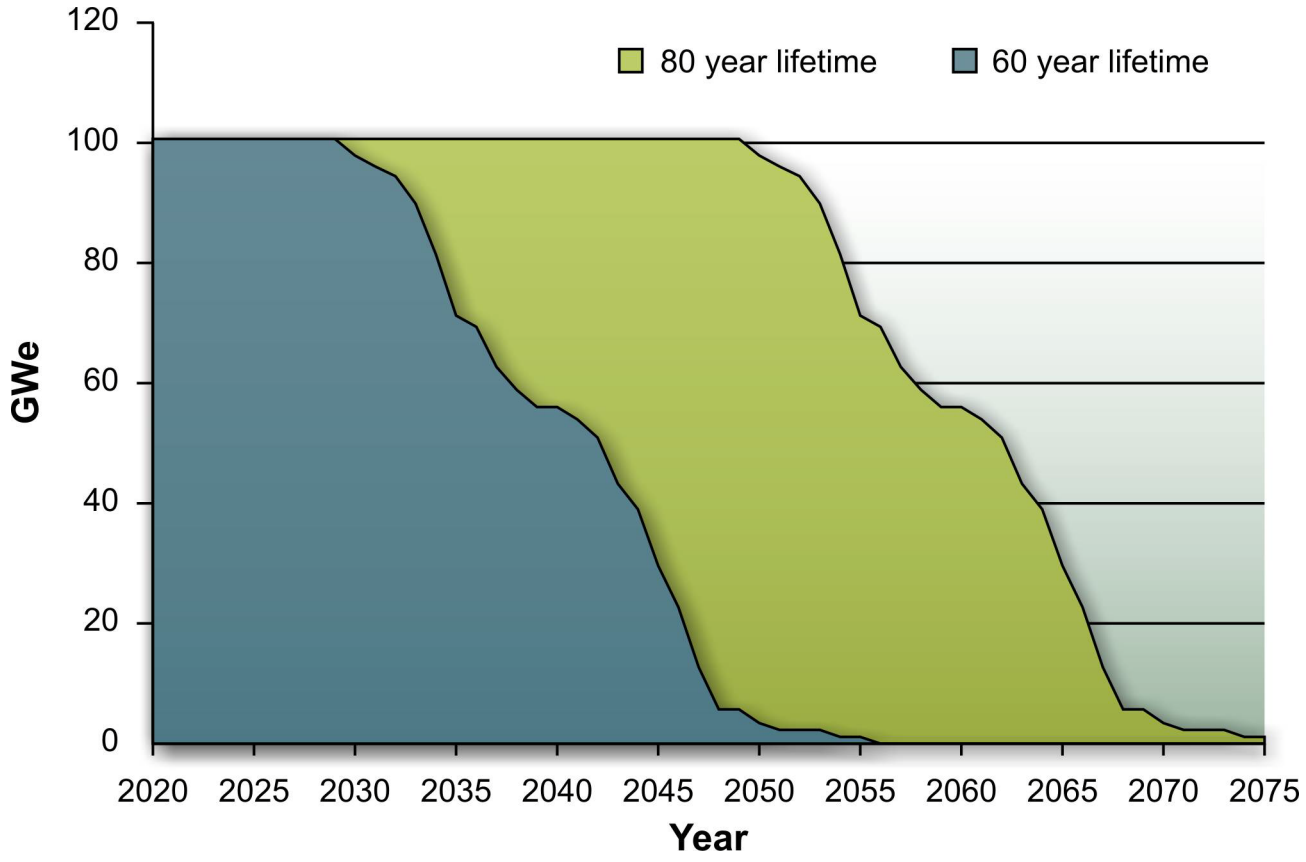
Key Program Driver

The potential for the production of 2000 GWe-years of low cost electricity from extending the life of the current nuclear power plants.



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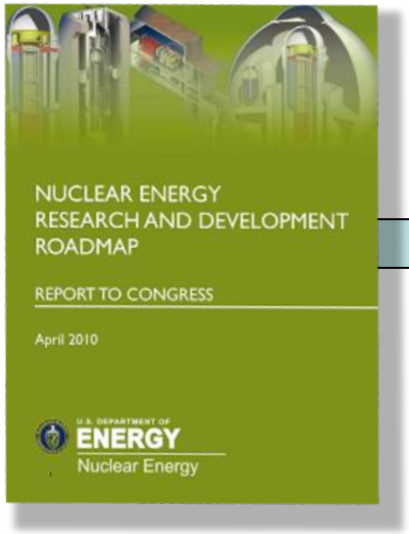
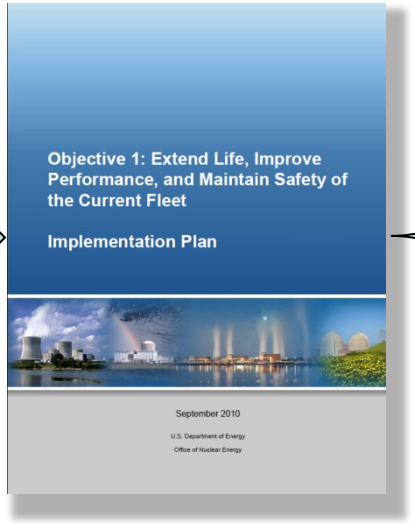
Implementation Plan





- *DOE / EPRI Joint Strategy*
- *Nuclear Materials Aging and Degradation*
- *Advanced Instrumentation, Information, and Control Systems*
- *Risk-Informed Safety Margins Characterization*
- *Advanced LWR Fuel Development*
- *Economics and Efficiency Improvements*

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Vision and Goals

Vision

- Enable existing nuclear power plants to safely provide clean and affordable electricity beyond current license periods (beyond 60 years)

Program Goals

- Develop fundamental scientific basis to allow continued long-term operation of existing LWRs
- Develop technical and operational improvements that contribute to long-term economic viability of existing nuclear power plants

- Funding: FY2010 $10.0M
  - FY2011 $28.1M
  - FY2012 $21.4M

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Five Research Pathways

1. Nuclear Materials Aging and Degradation - **develop the scientific basis for understanding and predicting long-term environmental degradation behavior of materials**
2. Risk-Informed Safety Margin Characterization - **better understand and characterize safety margins and improve the reliability and efficiency of plant operations**
3. Advanced Instrumentation, Information, and Control Systems Technologies - **address long-term aging and obsolescence of existing I&C technologies and establish a strategy to modernize I&C systems**
4. Advanced Nuclear Fuel Development - **develop high-performance, higher burn-up fuels with improved safety, cladding, integrity, and economics**
5. Economic and Efficiency Improvements - **address high impact emerging issues and improve the efficiency of the current fleet**

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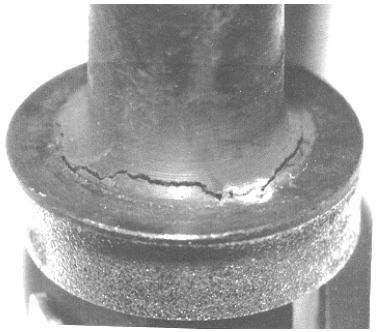
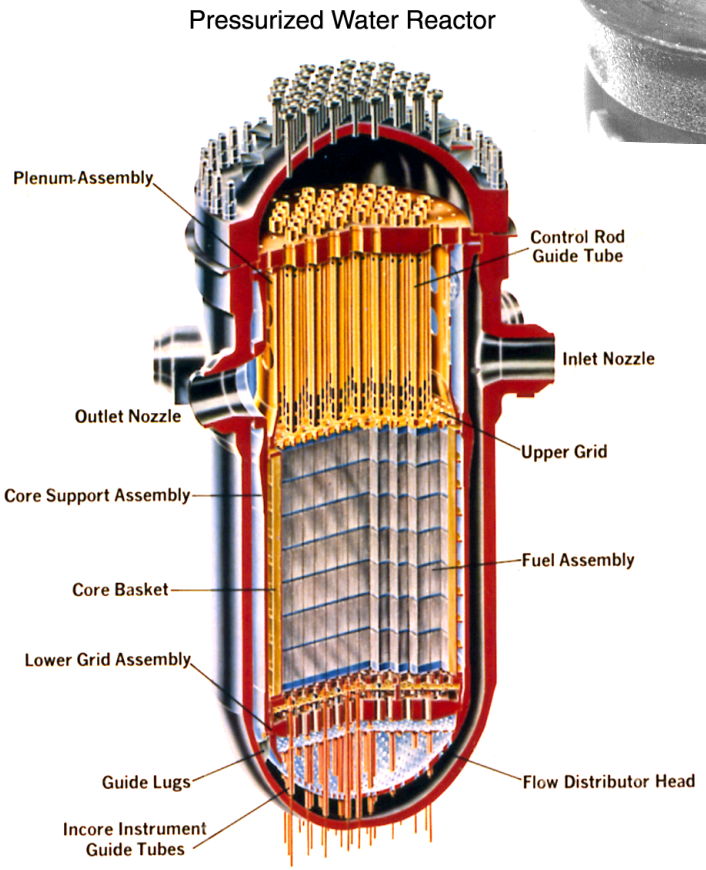
Extending service life of today's LWR fleet may create new material challenges

- **The LWRS R&D scope provides the scientific basis for understanding and predicting materials aging and degradation within components, systems, and structures**
  - Reactor metals (RPV's, internals, steam generators, balance of plant, and weldments)
    - **Mechanisms of IASCC**
    - **High-fluence effects on RPV steel**
    - Crack initiation in Nickel based alloys
  - Concrete
    - **Concrete aging for long term operation**
    - Monitoring tools for concrete
  - Buried piping
    - Assessment on long term piping performance
  - Cabling
    - Assessment of cable aging issues
  - Mitigation, repair, and replacement technologies
    - **Weld repair techniques**
    - Post irradiation annealing
    - Advanced replacement alloys





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Collecting Real Plant Data

- **Pilot Plant project with Constellation Energy (CENG) at Ginna and Nine Mile Point**
  - Reactor Vessel Internals Enhanced Aging Inspection
  - Comprehensive Containment Assessment
  - Investigation of Surveillance Samples for Projecting Reactor Vessel Life
  - Medium and low voltage power cable aging in adverse environments

- **Zion Decommissioning - materials samples**
  - Reactor Pressure Vessel segment
  - Cables
  - Concrete
  - Piping welds

- **Cooperating with NRC and EPRI**

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Conclusion

- The continued operation of the existing fleet is in the National interest as a key strategy for meeting climate change and energy supply goals
- Federal efforts are essential to stimulate and encourage industry efforts as well as to address the longer-term, high risk research that industry can not address
- Sustained R&D on long-term LWR operations is needed to identify issues and develop the technical basis that supports industry efforts to relicense plants for long-term operation
- Must continue cooperation with NRC and industry to identify appropriate R&D in support of long-term operation